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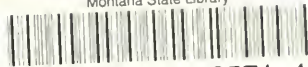
The destructive grasshopper (*Melanoplus*) of 1917

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Fifteenth Annual Report of the State Entomologist of Montana

INSECT PESTS OF 1917

THE MITES AND TICKS (ACARINA)

Red Spider (*Tetranychus bimaculatus* Harvey). Red spiders did considerable damage to raspberries in various parts of the State. The older growth was most seriously damaged and in many cases was completely killed. The new growth was severely injured later in the season. Control experiments were carried out with various insecticides with considerable success.

Pear-Leaf Blister Mite (*Eriophyes pyri* Pagnat). Pear-leaf blister-mite was reported as being injurious to apples in the Bitter Root Valley and other localities in the western part of the State. Some control experiments against this insect were carried on in conjunction with the State Board of Horticulture. As had been previously discovered, lime sulphur, sprayed when the buds were swelling, gave satisfactory results.

COCKROACHES AND GRASSHOPPERS (ORTHOPTERA)

Cockroaches (*Blatta germanica* Linn.). As usual, there were a few inquiries concerning the eradication of cockroaches in houses and business establishments.

Grasshoppers (*Melanoplus* sp.). A grasshopper outbreak, covering the lower Bitter Root Valley, Missoula County, the Flathead Indian Reservation, and Tobacco Plains was the most outstanding feature of the year. Smaller outbreaks occurred in the Missouri Valley between Three Forks and Townsend. Poisoned bran mash was used earlier in the season, followed by grasshopper-catching machines. The farmers caught many bushels of 'hoppers to use for chicken feed.

Shield-Backed Locust (*Peranabrus scabricollis* Scud.). This insect was found doing damage near Ronan, along with the *Melanoplus* spp. in the general outbreak. It did not take the poisoned bran mash as readily as did the *Melanoplus*.

THRIPS (THYSANOPTERA)

Grain Thrips (*Luophothrips striatus* Osb.). The sterility of

plants, causing a considerable loss in the crop, was noticed again this year. It is due to this insect, which attacks the ovary before the head leaves the boot and so injures it that the flower produces no kernel.

THE TRUE BUGS, PLANT LICE, ETC. (HEMIPTERA)

Potato Bug Feeder (*Perilus claudus* Say). This strikingly colored Pentatomid was found in many instances feeding on the larvae of the Colorado potato beetle, *Leptinotarsa decemlineata*.

Bedbugs (*Cimex lectularia* Linn.). Inquiries concerning the control and eradication of bedbugs were frequent. Our former fumigation experiments were repeated, and good results were obtained.

False Chinch Bug (*Nysius ericae* Uhl.). This insect was reported many times, being mistaken for the true chinch bug. It becomes exceedingly plentiful at times and is often accused of doing damage to wheat, though we have no records showing this to be true. It is often the cause of considerable damage to the younger and tenderer portions of vegetables in gardens.

Campylenchia curvata Fabr. This insect was sent in as doing damage to alfalfa. Alfalfa stems were sent in with the epidermis scraped off and punctures in the stems made in feeding and ovipositing. Many of the stems had eggs in them, several to one puncture.

Sugar-Beet Root-Louse (*Pemphigus betae* Doane). Wherever sugar beets have been grown, this insect has obtained a foothold. In the Yellowstone Valley the losses are considerable, due to lessened tonnage and a lowered sugar content of the beets.

Cabbage Aphis (*Aphis brassicae* Linn.). Cabbage aphis did not seem so plentiful this year as in previous years in spite of the increase in the number of gardens and the lack of care in a great many of them.

Apple Aphis (*Aphis pomi* DeG.). This insect was held somewhat in check by the late, cold spring and dry summer so that it was not as plentiful as heretofore. It has always been an important pest of apples but caused little damage this season.

Cottonwood Aphis (*Aretaphis* sp.). This insect seems to be spreading rapidly in this State and causing considerable damage to cottonwoods. Where these trees are the principal shade tree the damage becomes rather important. Badly infested trees lose their

leaves early in the summer, and in many cases the exuded honey dew is a considerable nuisance.

Fall-Grain Aphis (*Macrosiphum* sp.). There were inquiries regarding a species of aphis which was found on heads of nearly ripened wheat. It turned out to be a species of *Macrosiphum*, which is commonly found on wheat in the late summer but which apparently does no damage.

The Western Wheat Aphis (*Brachycolus tritici* Gill.). This insect was practically unknown this year. Heretofore it has caused serious losses in wheat, but in 1916 it was scarce, owing perhaps to the heavy winter-killing of wheat, and this year the winter-killing was greater and the insect so scarce that enough could not be found to continue the research studies.

Woolly Apple Aphis (*Schizoneura lanigera* Hausm.). The woolly aphis caused considerable damage in the Bitter Root Valley this season. It was exceedingly plentiful, more so than last season.

The Elm Gall Louse (*Schizoneura americana* Riley). Elm trees in various localities of the State suffered from the attacks of this insect. Some of the trees were very seriously affected, maturing little or no new growth.

Oyster Shell Scale (*Lepidosaphes ulmi* Linn.). This insect is becoming very abundant and troublesome in the small uncared-for orchards in western Montana. The thorough and consistent use of lime-sulphur sprays will hold it in check.

MOTHS AND BUTTERFLIES (LEPIDOPTERA)

Imported Cabbage Butterfly (*Pontia rapae* Linn.). The cabbage worm caused a great deal of loss in all localities of the State. The small gardens in the cities suffered the worst from this pest, as they were not as well taken care of as the large gardens. Zinc arsenite was substituted for Paris green in control work.

Cutworms (*Noctuidae*). Besides some species of cutworms attacking wheat, garden cutworms were abundant everywhere in the State. Reports of injury to all kinds of garden plants and requests for control information were frequent. Peas, beets, and cabbage seemed to suffer the most injury though other plants were frequently attacked.

Euavoa tristicula Morr. This cutworm caused considerable losses in wheat in the northern part of the State. As it works almost

entirely below the surface of the ground the control offers a considerable problem. Poisoned bran mash seems entirely ineffective.

Bud Moth (*Tructocera ocellana* Schiff.). The fall brood of the bud moth did considerable damage to the apples this year.

Mediterranean Meal Moth (*Ephestia kuehniella* Zell.). Stored food products in the line of cereals were frequently found to be infested with the larvae of this moth. It was also reported in ground feed, stored in bins. Opening up the mills in zero weather proved an effective means of control.

Indian Meal Moth (*Plodia interpunctella* Hubn.). This tiny reddish moth was reared from dried fruit shipped from California and condemned by the State Board of Health. The shipment consisted of pears, peaches, prunes, figs, and raisins, all infested to a greater or less degree.

Clothes Moths (*Tineola biselliella*). This common household pest was not reported this season as much as heretofore. Fumigation with cyanide of potassium was highly successful against it in a few instances where it was reported.

FLIES (DIPTERA)

Leather Jackets (*Tipulidae*). Larvae of a tipulid, probably *Tipula angustipennis*, were found in great numbers in a damp place in a wheat field. The farmer who saw them, first thought they were wireworms. No damage was done by them.

Mosquitoes (*Culicidae*). Some parts of the State were troubled with mosquitoes but owing to the very dry year they were not as bad as usual. No attempts were made at organized control work because of lack of funds.

Clover Seed Midge (*Dasyneura leguminicola* Lint.). This insect was caught in rather large numbers in clover at Arlee. It has apparently been present there for the last couple of years and has caused some loss in the clover seed crop, though never reported before. It was not found in any other locality, though it may be more or less generally present.

The March Fly (*Bibio albipennis* Say). Many farmers noticed this fly crawling on their wheat plants last spring, and suspected it of doing some damage. Inquiries regarding it were frequent, and any queer injury or unusual appearance of the plants was attributed to this insect, even though it is apparently harmless.

Horse Flies (*Tabanidae*). In the mountainous localities, horseflies were abundant most of the summer, causing considerable inconvenience to campers and people whose business required their presence in the mountains.

Currant Fruit Fly (*Epochra canadensis* Leow.). Very few currants were gathered in parts of Montana this year due to the injuries caused by this insect. Some poison bait sprays have been used with some success.

Wheat Sheath Miner (*Cerodontha femoralis* Meig.). The losses caused by this insect were not as great as previously. Control measures carried on in one locality seemed to have greatly decreased them.

Stem Maggot of Wheat (*Meromyza nigricentris* Macq.). This insect, in localities where the control of *Cerodontha femoralis* was carried out, was effectively controlled at the same time. The damage done in other places was difficult to estimate due to the losses through drought.

The Nose Fly (*Gastrophilus haemorrhoidalis* Linn.). The nose fly has gradually spread over the entire State and causes more and more trouble in the using of horses. A solid piece of leather from bit ring to bit ring just wide enough to protect the lips is the best protection.

Onion Maggot (*Phorbia ceparum* Meade). The onion maggot was a serious pest of both onions and radishes this year, wherever they were grown.

The Cabbage Maggot (*Phorbia brassicae* Boche). Cabbages grown in the northwestern portion of the State were severely injured by this maggot. Other parts of the State were almost free from any loss of this kind.

THE FLEAS (SIPHONAPTERA)

Fleas (*Siphonaptera*). Inquiries for flea control measures were received this year. The human flea, *Pulex irritans*, was the most common offender. This also lives on mice, which were in some cases the original source of infection.

THE BEETLES (COLEOPTERA)

The Larder Beetle (*Dermestes lardarius* Linn.). The usual inquiries regarding this pest of food products were received in this

office. This insect is perhaps more plentiful and does more damage than is ordinarily realized, and in these days of saving all food products, it should be more thoroughly looked into by the house-keeper.

Wireworms (*Elateridae*). The true wireworms have been held responsible for considerable damage to wheat in various places. They have caused some losses in potatoes by boring into the tubers, rendering them unfit for use.

Dung Beetle (*Iphodius inquinatus* Hbst.). The swarms of these insects in the spring and fall attracted considerable attention among farmers, especially those working in the fields where the beetles were flying and feeding on fresh manure. Some farmers were rather concerned regarding this insect, fearing it might be a pest of some kind.

June Beetle (*Lachnosterna* sp.). Beetles of this genus were unusually plentiful in eastern Montana the past season. They were reported as being so abundant that campers were greatly annoyed by their hitting the tent and alighting on the bed. Beetles were even found literally piled against the sides of dwellings where they had struck and fallen to the ground. No damage was reported as having been done by the larvae.

A Sunflower Pest (*Chrysomela exclamationis* Fab.). This beetle, resembling a Colorado potato beetle, was found in great numbers on wild sunflowers and some times on cultivated ones. Where sunflowers are grown for use in the silo, this insect is liable to become a serious pest.

Flea Beetles (*Epitrix* sp.). Flea beetles were reported on all garden crops. Potatoes and beets were injured the most, but turnips, radishes, and other vegetables were not free from attack.

Cottonwood Blotch Miner (*Olontota* sp.). Reports of injury caused by this insect came from the western part of the State, though in past years it has been generally distributed over all parts of Montana.

Cottonwood Leaf Beetle (*Lina scripta* Fab.). Reports of injury by this insect were not as plentiful as usual, and injury was not noticed by State workers.

Colorado Potato Beetle (*Leptinotarsa decemlineata* Say). The Colorado potato beetle was more plentiful this year than last and, owing to the fact that Paris green was so very expensive, many

people were at a loss how to get rid of them. In many places potato plots were practically ruined before the owner realized it. Arsenite of zinc was recommended as a substitute for Paris green, to be used pound for pound, and results were very successful.

False Wireworms (*Elcodes* sp.). False wireworms were reported to be injuring wheat in widely separated localities about the State. Some fields were found where the injury was doubtless due to false wireworms, but some were also found where other agencies caused most of the damage attributed to this pest.

The Saw-Toothed Grain Beetle (*Silvanus surinamensis* Linn.). This insect was found in a carload of dried fruit which was condemned by the State Board of Health. The fruit, consisting of prunes, peaches, figs, raisins, and pears, was unfit for use and a complete loss. The fruit was shipped from California.

Blister Beetles (*Epicauta maculata* Say and *E. Pennsylvanica* D. G.). These beetles are both friends and enemies, feeding on various crops in the adult stage and on grasshopper eggs in the larval stage. They were unusually plentiful in the localities heavily infested with grasshoppers this season.

Nuttall's Blister Beetle (*Cantharis nuttalli* Say). In a few instances alfalfa was reported to have been injured by Nuttall's blister beetle. The damage was not extensive, nor were the reports of widespread origin.

Lesser Clover Leaf Weevil (*Phytonomus nigrivestris* Fab.). This enemy of clover caused considerable damage in western Montana. It feeds on the heads and young leaves of clover, causing a loss in the seed crop as well as a lowering of the hay yield.

Currant Weevil (*Pseudanthrenus validus* Dietz). This weevil, in cooperation with the fruit fly, was responsible for some of the currant losses. It is not so readily noticed, however, as it attacks the currants before they are beginning to turn, causing them to fall to the ground and dry up.

BEEES AND ALLIED FORMS (HYMENOPTERA)

Wasps (*Vespalac*). A report was sent in to this office of wasps causing considerable loss by feeding on ripened or partially ripened strawberries, making them unfit for use. While wasps show a decided liking for fruit, it is not often that they are the cause of any loss.

Leaf Cutter Bees (*Megachile* sp.). Certain species of trees and shrubs, especially ash trees and rose bushes, suffered considerably from the depredations of these insects. In one instance a few rose bushes were almost entirely defoliated, only the midrib of the leaves being left.

Willow Saw-Fly (*Pteronidia ventralis*). Willows used as shade trees were reported as being seriously injured by the larvae of the willow saw-fly.

Pear or Cherry Slug (*Eriocampoides cerasi* Linn.). Cherry trees in the western part of the State suffered from the attacks of this pest. The somewhat flattened green slugs feed on the leaves and completely skeletonize them, giving the trees a brownish appearance.

Ants (*Formicina*). Ants continue to be reported as one great source of trouble to the housekeeper. Usually a little concerted action and careful use of carbon bisulphide will control them.

ECONOMIC ENTOMOLOGY AND THE WAR

The fact of the world's shortage of food supplies is now well known by the American people. It is not as well known that insects annually destroy about ten per cent of the agricultural output of the nation—an amount sufficient to relieve to a considerable extent the pressure at this critical time. The first year of the war brought us in Montana face to face with several rather serious insect problems. Grasshoppers, mentioned in another part of this report, and numerous other insects became prominent during the year and it was apparent early in the season that this office could do a real service by aiding the farmers to prevent losses.

There has also grown up in recent years a very lively interest in the control of ground squirrels and naturally this office had much to do in directing the campaign against them. In many counties the county agricultural agents cooperated with the farmers in the preparation and distribution of poisoned grain, resulting in the destruction of hundreds of thousands and perhaps millions of squirrels. There can be no doubt that this one piece of work alone saved a great deal of agricultural produce during the year.

In view of the importance of pest control work during the period of the war, the department took steps to organize to meet the demands for assistants. The assistant entomologist, Mr. H. L. Sea-

mans, was placed in the field and kept there through the larger part of the season. Mr. A. L. Strand, who graduated from the entomology course of the college in 1917, was also employed and sent out to direct the farmers in pest control. Two senior students, Mr. Corkins and Mr. King, were also employed in this work at times. As a result, the State was quite well covered and all of the most important outbreaks were visited and the farmers in each instance were helped.

During the year the State entomologist prepared and delivered at the annual meeting of the American Association of Economic Entomologists, at Pittsburgh, Pa., an address entitled "Economic Entomology in the Service of the Nation." This appeared in the Journal of Economic Entomology, Volume 11, pages 16 to 27.

COOPERATION WITH THE EXTENSION SERVICE

The extension service of the college does not employ an entomologist and it has not contributed to the control of insect pests. It has been the policy of the State entomologist's office to cooperate heartily with the extension service and to keep in close touch with the county agricultural agents and with their State leader. Accordingly, we have received many telegrams, letters, and telephone messages from county agents, asking for advice or calling for assistants to be sent to their counties to aid the farmers.

THE GRASSHOPPER OUTBREAK OF 1917

During the fall of 1916 reports reached this office indicating that grasshoppers had been abundant during the summer in the Flathead Indian Reservation in the northern part of Missoula County. County agents of the surrounding counties were warned and steps were taken to do everything possible during the spring to prevent or reduce the damage that might reasonably be expected in 1917. Assistant State Entomologist H. L. Seamans made a thorough survey of the situation in the early spring.

On the occasion of the first trip, in the middle of April, eggs had been found in abundance and on this early date dead grasshoppers of the previous year could be found, as well as evidence of the damage that had been done to winter wheat. Eggs were found in ditch banks, fence rows, especially around alfalfa and clover fields. With many of these eggs were found an abundance of ground beetle larvae and adults (*Harpalus* sp.). The first grasshopper eggs hatched, so far as our records show, about May 15th.

While the grasshopper troubles in 1917 extended scatteringly throughout the State, they centered mainly in an irregular area extending through parts of Missoula, Flathead, and Sanders counties. Roughly speaking, the region affected extended from near the town of Stevensville to Flathead Lake, a distance of about 70 miles. There were more or less grasshoppers throughout this region, but in spots they were very abundant and in some places practically everything green was eaten off. Much more damage would have been done but for the control work which was organized by the county agents and this office in cooperation. The young grasshoppers hatched through a long-drawn-out period and those that hatched first were entirely or quite full grown before the last ones appeared. At no time in the fore part of the season could we tell just how severe the outbreak was to be. As the season advanced and many of the insects had acquired wings the grasshoppers spread out from the more or less restricted areas where they had hatched and the infestation became general. It sometimes happened that after the grasshoppers had been killed in a locality others moved in, which made the conditions somewhat discouraging to the farmers. Along with the grasshoppers came a spell of severe dry weather and some crops which had been saved from the insects were afterwards severely injured by lack of moisture. Grasshoppers were also very abundant and some damage was done in the region extending through the western part of Gallatin County and the southern part of Broadwater County. Control operations were carried out here, also.

Extracts from a letter written by Sidney T. Rogers of Three Forks, whose land lies in Broadwater County, are here presented:

"About July the grasshoppers were so thick in my wheat field you could scarcely see wheat heads and were simply destroying it completely. I conferred with our county agent and in response he came with Mr. Seamans and they together constructed a 'hopper machine. I placed my son and daughter in the field on horses attached to each end and they caught twenty-eight (28) gunny sacks of 'hoppers, a fair estimate of 50 bushels.

"I am fully convinced if it had not been for the assistance of Prof. Seamans and Mr. Gordon, our Broadwater County agent, I would have lost my entire wheat crop of 231 acres."

* * * * *

"I am feeding the 'hoppers to our chickens and they have laid

eggs all this fall and to date, and I am fully satisfied they are a good ration for fattening, as they eat them up clean."

WORK WITH THE COUNTY AGENTS

In organizing the control work we cooperated mainly with the county agricultural agents. These men were familiar with the field conditions and with the influential farmers and but for the extension organization we could not have accomplished our work. In the course of our experience it developed that the natural and effective way to accomplish what we were after was to leave the county agents to call all meetings, organize them, and be mainly responsible for their success. Representatives from this office assumed merely an advisory responsibility, delivering lectures and making demonstrations whenever desired and securing information regarding sources of arsenic and other necessary ingredients for the poison formula.

ORGANIZATION OF THE FARMERS

The procedure in organizing control efforts among the farmers was generally to first enter the district and get some information regarding existing conditions, the abundance of grasshoppers, the amount of damage being done, and other points of importance, locally, for use in the work. The county agent then called a meeting of the citizens which was addressed by himself and by the entomologist. The habits of grasshoppers, conditions of the locality so far as we knew them, methods of control, together with a review of the experience in other localities, were discussed and the farmers were organized and asked to form committees. Quite often the committees were made up in part of people from town and in part of farmers for it was recognized that the interests of the town were affected as well as those of the country. Committees for soliciting and for purchasing were appointed and dates for further meetings were fixed. In some instances one committee managed the whole campaign for the community. Dates were appointed when the farmers came together and mixed the poisoned bait. In some instances the poisoned ingredients were delivered before the meeting and in some cases they were brought as the people came to the meeting. The committees sold the poison to the farmers, who took it home and spread it immediately.

One of these "mixing bees" was held on the river bank at Irvine

Flats. A few over ninety men were present on this occasion and about forty-five farm wagons. The whole community was assembled at this point and worked all day preparing the poisoned bran mash which late in the afternoon was shoveled into the back end of the wagons and spread over the valley and foothills. Thirty-five wagons were used in spreading this poison. These were lined up by groups of five and driven over the country in long, broad swaths.

In this neighborhood grasshoppers were incredibly abundant but on returning a few days later relatively few could be found. Such drives as this were organized throughout a territory extending over some 200 square miles, and some 10,000 pounds of white arsenic were used, as well as many carloads of bran and some carloads of lemons and oranges. Tremendous numbers of grasshoppers were killed and the damage that was done in spite of the control efforts was due largely to grasshoppers which hatched later in the same localities or which migrated in from the surrounding foothills and uncultivated lands. The spell of dry weather which occurred at the same time had the effect of causing the grasshoppers to concentrate on low-lying lands which remained green longer and it was quite clear that the grasshoppers moved considerable distances to find such green areas. It was soon found that in some cases a single poisoning of the field or its borders could not be depended upon to protect the crop throughout the season. In some instances, after having poisoned earlier in the season, the farmers resorted to the use of the grasshopper machines to further protect the crops. It was, of course, hoped all the time that rains would come. If it had been known at the outset that rains would be so long delayed, in many instances the farmers would never have made the effort to save the crops. In some cases the efforts were successful and in some they were not, but I believe that the failure was due very largely to the dry weather, which not only itself damaged the crop, but caused concentration of the grasshoppers in the crops.

COOPERATION WITH THE BUREAU OF ENTOMOLOGY

Early in the grasshopper outbreak we entered a cooperative arrangement with and had the assistance of the Bureau of Entomology, U. S. Department of Agriculture. Mr. C. W. Creel, who is in charge of the Forest Grove Entomological Station of the Bureau in Oregon, came to Montana about June 1st with assistants and

remained until August 1st. It was most fortunate that we had this aid from the Federal government, as there was more work than this office could accomplish. We were also benefited by the fact that the Federal government supplied certain funds for the treatment of public lands. In many instances the farmers were not willing to treat their own lands unless the public lands in the vicinity might also be treated, thus preventing the entrance of grasshoppers after the farms had once been cleaned up. The assistants with Mr. Creel were Mr. Rockwood and Mr. Taylor.

KINDS OF GRASSHOPPERS IN THE OUTBREAK

From the fragments of grasshoppers which were found in April, which were the remains of those present the year before, it became evident that the species concerned was the well-known lesser migratory locust, *Melanoplus atlantis* Riley, or a closely related species, and from the nymphs which were found during the early part of the season we had further evidence that the species concerned belonged in the *atlantis* group. When adult grasshoppers, however, began to emerge about July 8th, it was learned that they more closely resembled the old Rocky Mountain migratory locust which fifty years ago wrought extensive damage in the northwestern States. As more and more of the insects reached the adult condition it was evident that the great mass of them belonged to this form. Accordingly, large numbers of the specimens were taken for future study.

We cannot say definitely at this time just what species this grasshopper is. However, for present purposes it is enough to say that, if it is not the Rocky Mountain migratory locust, it is very closely related to it. It is a long-winged form and a good flier. We did not witness any extensive migrations of the species, but such migrations were reported by the residents.

It is of much importance to determine as soon as possible whether or not it is the destructive species of fifty years ago for it is desirable to know whether potentially this grasshopper is as injurious as that one. Accordingly, an effort will be made to determine more closely the specific identity of this insect.

NATURAL ENEMIES

In our journeyings through the region affected by this grasshopper we watched for the parasites which might be of service in

holding the outbreak in check and on July 8th many flesh flies (*Sarcophaga*) were seen and from this day on, periodically, they were found in great abundance wherever the grasshoppers occurred. Large numbers of dead grasshoppers were found on the ground and many examinations revealed that the maggots were in the grasshoppers in great numbers. There is much reason to believe that, if this outbreak fails to develop into a seriously extensive one, it will be due to these flies which appeared in innumerable numbers, depositing young maggots on the adult insects.

EGGS IN THE FALL

Assistants were sent to the region in the fall who made thorough surveys for evidence of egg-laying, for it was desired to know if we were to have a recurrence of the grasshopper outbreak in 1918. Through several days of searching no grasshopper eggs whatever were found and from this fact it is hoped that there will not be any serious trouble next season.